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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/828,635	04/05/2001	Kyusik Sin	K35R1681/3480P	5517

29141 7590 09/29/2005

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EXAMINER

BERNATZ, KEVIN M

ART UNIT	PAPER NUMBER
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1773

DATE MAILED: 09/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/828,635

Applicant(s)

SIN ET AL.

Examiner

Kevin M. Bernatz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Examiner's Comments

1. Upon reconsideration and partly in view of the decision by the Board of Patent Appeals and Interferences on July 29, 2005, the finality of the rejection of May 27, 2003 is withdrawn and prosecution reopened. The Examiner apologizes for the inconvenience caused by the necessity of the reopening of prosecution.

An office action on the merits follows below:

Maintained Rejections

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 6, 7 and 17 – 20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The above rejection is maintained for the reasons of record as set forth in Paragraph No. 5 of the Office Action mailed on December 26, 2002.

New Rejections

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1 – 5 and 8 – 17 are rejected under 35 U.S.C. 102(a) as being anticipated by Noma et al. (WO 2001-03130 A1). See U.S. Patent No. 6,501,627 B2, which is the U.S. equivalent of WO '130 A1.

Regarding claim 1, Noma et al. disclose a magnetic head (i.e. applicants' "sensor") (*title*) comprising first (*Figure 4, element 14*), second (*element 16*) and third (*element 18A*) ferromagnetic layers that are interleaved with first (*element 15*) and second (*element 17*) nonferromagnetic layers, said first nonferromagnetic (non-FM) adjoining said first and second ferromagnetic (FM) layers, said second non-FM layer adjoining said second and third FM layers (*see Figure*), said first and third ferromagnetic layers having magnetic moments with directions that are fixed in response to an applied magnetic field (*col. 6, lines 39 – 44 and col. 7, lines 8 – 16*), said second ferromagnetic layer having a free portion and a fixed portion, said free portion having a magnetic

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moment with a direction that rotates in response to said applied magnetic field and said fixed portion have a magnetic moment with a direction that does not rotate in response to said applied magnetic field (*col. 4, lines 15 – 28, where the Examiner notes that the free portion is the portion of the free layer located between the two tab regions, i.e. the portion of the free layer not under the soft magnetic layers 18A and 18B in Figure 4*).

Regarding claim 2, Noma et al. disclose fixed and free portions meeting applicants' claimed structural limitations (*col. 4, lines 15 – 28; col. 7, lines 52 – 61; and Figure 4*).

Regarding claims 3 and 8, Noma et al. disclose non-FM layers meeting applicants' claimed material limitations (*col. 6, lines 39 – 63 – e.g. copper and ruthenium*).

Regarding claims 4 and 5, Noma et al. disclose antiferromagnetic (AFM) layers meeting applicants' claimed limitations (*Figure 4, elements 13 and 19A; and col. 12, lines 23 – 29*).

Regarding claim 9, Noma et al. disclose a fourth FM layer (*element 18B*) adjoining said second non-FM layer (*element 17*) and separated from said third FM layer (*element 18A*).

Regarding claim 10, Noma et al. disclose magnetic moments meeting applicants' claimed limitations (*Figure 4 and col. 6, line 39 bridging col. 7, line 16*).

Regarding claim 11, Noma et al. disclose a sensor comprising a FM pinned layer (*Figure 4, element 14*) and a ferromagnetic free layer (*element 16*) that are separated by an electrically conductive spacer layer (*element 15 and relevant disclosure thereto*),

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a pinning structure adjoining said pinned layer and adapted to fix a magnetic moment of said pinned layer in a first direction (*element 13 and relevant disclosure thereto*), a bias structure adjoining said free layer and adapted to stabilize magnetic domains of said free layer in a second direction (*elements 18A and 19A and relevant disclosure thereto*), said bias structure including a FM bias layer (*element 18*) exchange coupled (*col. 7, lines 52 – 61*) to a portion of said free layer (*element 16*) by a nonferromagnetic layer (*element 17*).

Regarding claims 12 – 16, these limitations are addressed per claims 2 – 10 above.

Regarding claim 17, Noma et al. disclose a sensor comprising a first (*element 18A*) and second (*element 18B*) FM layers that are disposed substantially in a plane, a third FM layer (*element 16*) that is not disposed in said plane, said third FM layer having a first, second and third portion meeting applicants' claimed structural limitations (*as described above with regard to the "free portion" and the two tab regions*), a non-FM electrically conductive layer (*element 15*) adjoining said third FM layer distal to said first and second FM layers, and a fourth FM layer (*element 14*) adjoining said conductive layer, wherein said fourth FM layer has a magnetic moment fixed in the presence of an applied magnetic field (*as described above with regard to element 14*), said first, second and third portions meeting applicants' claimed magnetic moment limitations (*as described above with regard to the "free portion" and the two tab regions*).

6. Claims 1 – 4, 6 – 12 and 14 – 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Mack et al. (U.S. Patent No. 6,462,919 B1) as evidenced by Schwarzl (U.S. Patent App. No. 2001/0050859 A1).

Regarding claim 1, Mack et al. disclose a sensor (*title*) comprising first (*Figure 6A, element 212*), second (*element 208*) and third (*element 204B*) ferromagnetic layers that are interleaved with first (*element 210*) and second (*element 206B*) nonferromagnetic layers, said first nonferromagnetic (non-FM) adjoining said first and second ferromagnetic (FM) layers, said second non-FM layer adjoining said second and third FM layers (*see Figure*), said first and third ferromagnetic layers having magnetic moments with directions that are fixed in response to an applied magnetic field (*col. 6, line 43 bridging col. 8, lines 64 – wherein the pinned layer is taught to be fixed normal to the air bearing surface (ABS) and the exchange tab structure is fixed along the ABS direction*), said second ferromagnetic layer having a free portion and a fixed portion, said free portion having a magnetic moment with a direction that rotates in response to said applied magnetic field and said fixed portion have a magnetic moment with a direction that does not rotate in response to said applied magnetic field (*col. 4, lines 22 – 38; col. 6, lines 43 – 67; and col. 7, line 39 bridging col. 8, line 64*).

Regarding claim 2, Mack et al. disclose fixed and free portions meeting applicants' claimed structural limitations (*col. 4, lines 22 – 38; col. 6, lines 43 – 67; and col. 7, line 39 bridging col. 8, line 64*).

Regarding claims 3 and 8, Mack et al. disclose non-FM layers meeting applicants' claimed material limitations (*col. 8, lines 39 – 63*). The Examiner takes

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Official Notice that spacer layers in GMR elements are inherently electrically conductive layers (see *Schwarzl, Paragraphs 0004, 0005 and 0018*).

Regarding claim 4, Mack et al. disclose antiferromagnetic (AFM) layers meeting applicants' claimed limitations (*Figure 6A, elements 202B and 214; col. 6, lines 43 – 55; and col. 8, lines 34 - 63*).

Regarding claims 6 and 7, Mack et al. disclose a fourth FM layer (*Figure 6B, element 224B*), and a third non-FM layer (*element 226B*), wherein said third non-FM layer adjoins said third (*element 228B in Figure 6B, 204B in Figure 6A*) and fourth FM layers, and an AFM layer adjoining at least one of said first and fourth FM layers (*elements 238 and 222B in Figure 6B*).

Regarding claim 9, Mack et al. disclose a fourth FM layer (*element 204A*) adjoining said second non-FM layer (*element 230A and 230B and col. 4, line 67 bridging col. 5, line 5 – where the Examiner notes that Mack et al. teach embodiments wherein all of the non-magnetic material forming layers 230A and 230B need not be removed, hence providing for embodiments having a continuous layer extending across the entire surface of the free layer, element 208*) and separated from said third FM layer (*element 204B*).

Regarding claim 10, Mack et al. disclose magnetic moments meeting applicants' claimed limitations (*col. 6, line 43 bridging col. 8, lines 64 – wherein the pinned layer is taught to be fixed normal to the air bearing surface (ABS) and the exchange tab structure is fixed along the ABS direction*).

Regarding claim 11, Mack et al. disclose a sensor comprising a FM pinned layer (*Figure 6A, element 212*) and a ferromagnetic free layer (*element 208*) that are separated by an electrically conductive spacer layer (*element 210, wherein the Examiner takes Official Notice that spacer layers in GMR sensors are electrically conductive, as described above*), a pinning structure adjoining said pinned layer and adapted to fix a magnetic moment of said pinned layer in a first direction (*element 212; col. 6, lines 43 – 55; and col. 8, lines 34 - 63*), a bias structure adjoining said free layer and adapted to stabilize magnetic domains of said free layer in a second direction (*elements 206B, 204B and 202B and relevant disclosure thereto*), said bias structure including a FM bias layer (*element 204B*) exchange coupled (*col. 8, lines 34 - 64*) to a portion of said free layer (*element 208*) by a nonferromagnetic layer (*element 206B*).

Regarding claims 12 and 14 – 16, these limitations are addressed per claims 2 – 10 above.

Regarding claim 17, Mack et al. disclose a sensor comprising a first (*Figure 6A, element 204A*) and second (*element 204B*) FM layers that are disposed substantially in a plane, a third FM layer (*element 208*) that is not disposed in said plane, said third FM layer having a first, second and third portion meeting applicants' claimed structural limitations (*as described above with regard to the "free portion" and the two outer exchange tab regions*), a non-FM electrically conductive layer (*element 210 and inherently conductive based on Official Notice as described above*) adjoining said third FM layer distal to said first and second FM layers, and a fourth FM layer (*element 212*) adjoining said conductive layer, wherein said fourth FM layer has a magnetic moment

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fixed in the presence of an applied magnetic field (*as described above with regard to element 212*), said first, second and third portions meeting applicants' claimed magnetic moment limitations (*as described above with regard to the "free portion" and the two outer exchange tab regions*).

Regarding claims 18 and 19, Mack et al. disclose first and second non-FM electrically conductive exchange coupling layers (*elements 206A and 206B*) meeting applicants' claimed structural and material limitations (*col. 8, lines 34 – 63*).

Regarding claim 20, Mack et al. disclose first and second AFM layers meeting applicants' claimed structural limitations (*elements 222A and 222B*).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 5 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mack et al. as applied above, and further in view of Beach (U.S. Patent App. No. 2004/0136122 A1).

Mack et al. is relied upon as described above.

While Mack et al. discloses first and second AFM layers and does not *require* them to be the same material, Mack et al. does not provide any teaching as to whether

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one of ordinary skill would use the same material or different materials, as required in claims 5 and 13.

However, Beach teaches that it is known in the art that one method of forming magnetic heads possessing upper and lower AFM layers is to form the first AFM layer of a material having the highest blocking temperature and the second with a lower blocking temperature so that the 90 degree difference in field angle could be set at different temperatures (*Paragraphs 0003 – 0007*). While Beach is directed to a new and novel technique using the same AFM materials in such a situation, the Examiner deems that one of ordinary skill in the art would readily appreciate that both techniques are acceptable for producing functioning MR heads and the choice primarily depends on the processing desires of the producer (e.g. in cases where one could not take advantage of the “spin flop effect” utilized by Beach to be able to use the same AFM materials for the upper and lower AFM layer).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Mack et al. to utilize AFM layers meeting applicants' claimed limitations as taught by Beach since this allows a 90 degree difference in field angle to be set for the sensor.

9. Claims 6, 7 and 18 – 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noma et al. (WO '130 A1) as applied above, and further in view of Mack et al. ('919 B1).

Noma et al. is relied upon as described above.

Regarding claims 6 and 7, Noma et al. fail to disclose a fourth FM layer and a third non-FM layer meeting applicants' claimed limitations.

However, Mack et al. teach that a functionally equivalent structure to Noma et al.'s "exchange tab" structure with a ruthenium layer completely across the free layer (*Noma et al., Figure 4, element 17*) is a ruthenium layer that is only located between the two exchange tab structures on the end regions (*Mack et al., Figure 6A, elements 206A and 206B*).

It would, therefore, have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Noma et al. to utilize a fourth FM layer and third non-FM layer meeting applicants' claimed structural limitations as taught by Mack et al., since such a structure is a known structural equivalent to the structure utilized by Noma et al. and substitution of known equivalents requires no express motivation as long as the prior art recognizes the equivalency.

Regarding claims 18 - 20, Mack et al. disclose the claimed structure for the same reasons as recited above, where the Examiner notes that the FM layers in the "exchange tabs" are the claimed "first" and "second" FM layers and the Ru layers between the ferromagnetic layers in the "exchange tab" structure and the free layer (*Mack et al., Figure 6A, elements 206A and 206B*) are the first and second non-FM layers.

Response to Arguments

10. The prior rejection of claims 1 - 20 under 35 U.S.C § 103(a) – Various references

Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

The above noted rejection has been withdrawn in view of the decision by the Board of Patent Appeals and Interferences.

11. The rejection of claims 6, 7 and 17 - 20 under 35 U.S.C § 112 – 1st Paragraph

Applicant's arguments have been considered and have been addressed by the Board of Patent Appeals and Interferences.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB

August 10, 2005

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Kevin M. Bernatz, PhD
Primary Examiner

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